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DNA STRUCTURE

Deoxyribonucleic Acid

→ DNA is the information molecule

→ it stores instructions for making other large molecules called proteins

→ these instructions are stored inside each of your cells, distributed among 46 long structures called chromosomes

→ usually exists as a double-stranded structure, with both strands coiled together to form the characteristic double-helix

→ it has 3 main components:

1. Deoxyribose (a pentose sugar)
2. Base (4 different ones)
3. Phosphate

RNA	DNA
* single-stranded	* double stranded
* has uracil as a base	* has thymine as a base
* ribose as the sugar	* deoxyribose as the sugar
* uses protein-encoding information	* maintains protein-encoding information

→ genomic DNA is tightly packed in the process called DNA condensation, to fit in the small volumes of cell

→ in eukaryotes, DNA is located in the cell nucleus, with small amounts in mitochondria and chloroplasts

→ in prokaryotes, the DNA is held within an irregularly shaped body in the cytoplasm called the nucleoid

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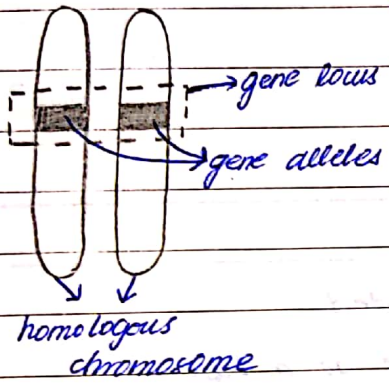
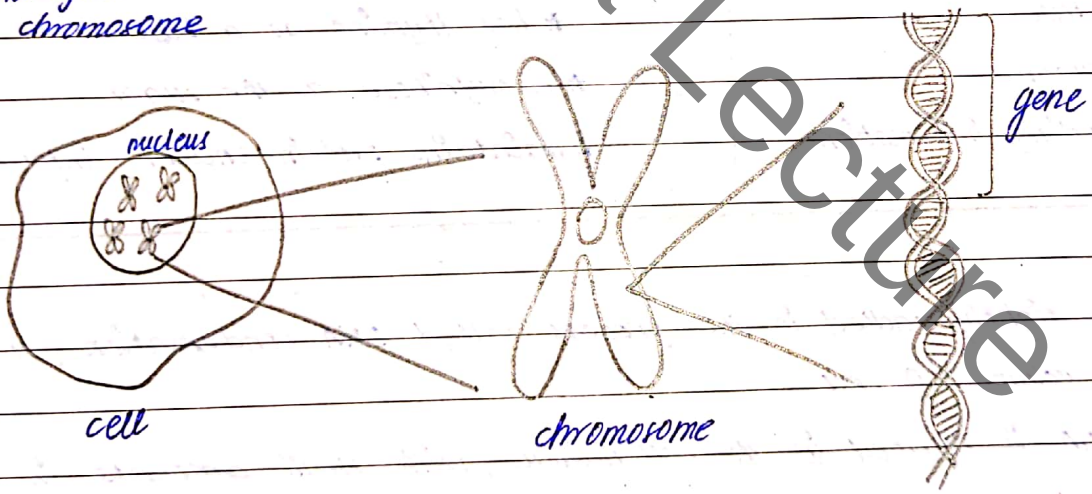
Chromosomes

→ thread-like structures located inside the nucleus of animal and plants
→ each chromosome is made up of a protein and a DNA molecule
→ passed from parents to offsprings, DNA contains the specific instructions that make each type of living creature unique
→ strongly stained by some colorful dyes

homologous chromosome: one of a pair of chromosomes with the same gene sequence, loci, chromosomal length and centromere location





genes: biological blueprints
give us attributes & traits
every cell has all the information needed to make a complete you
located on chromosomes that are 46 in numbers containing thousands of genes

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→ information stored in DNA is transferred to RNA and then expressed in the structure of proteins

→ two steps in this process:

(i). Transcription : information transcribed from DNA to mRNA

(ii). Translation : information in mRNA translated into primary sequence of a protein

DNA → RNA → Protein → Trait
↓ Transcription
↓ Translation

→ genes contain the information for the production of proteins which specify traits

→ since, genes are inherited traits are also inherited

→ in sexually reproducing organisms, cells have a homologous pair of chromosomes (one from each parent)

→ chromosomes from a homologous pair have the same genes but can have different alleles

allele : different form of a gene / variations of a gene / alternative forms of gene
may be dominant or recessive
e.g gene : eye color
allele : blue or brown

if the alleles are homozygous, the two genes at the locus are the same
if the alleles are heterozygous, the two genes at the locus are different

→ each gene controls the production of one protein

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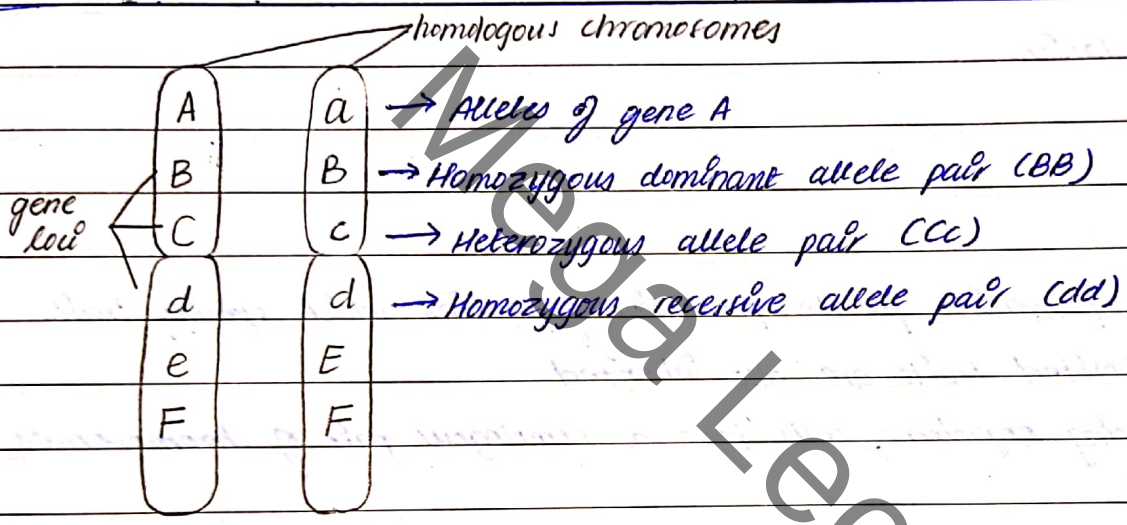
Dominant Allele

* the allele which can express itself in phenotype even in single copy
* the allele which can mask the effect of other alleles
* AA or Aa
* A is the dominant allele

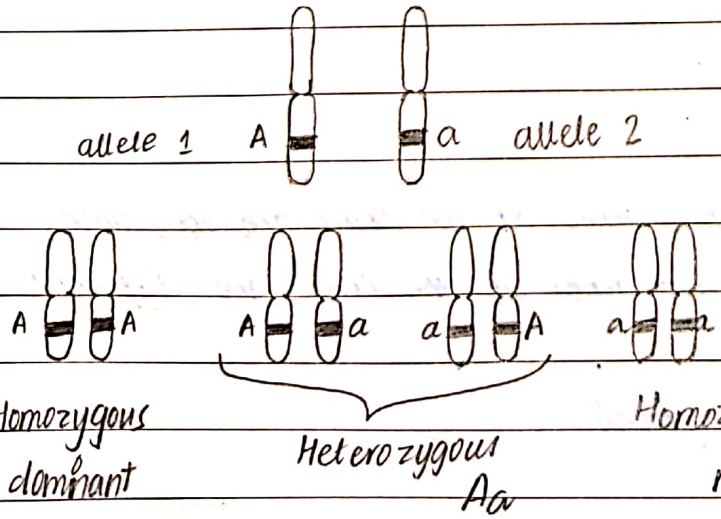
Recessive allele

* the allele which can only express itself in phenotype when it has a double copy
* aa
* a is the recessive allele



Genotype:

→ representation of genes in the form of alleles involved i.e. Heterozygous and Homozygous



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Phenotype:

→ 2 types : ①. Dominant ②. Recessive

1. The phenotype which is present more in population for any one trait
(e.g/ tall is dominant to short
black is dominant to colored

2. The phenotype which is less in population for any one trait
(e.g/ shortness
colored eyes

Genotype Vs Phenotype:

e.g/ ear lobe

alleles : dominant — free 'E'

recessive — attached 'e'

Trait	Phenotype	Genotype
ear lobe	free lobe	Homozygous EE
		Heterozygous Ee
	attached	Homozygous ee

INHERITANCE

→ transmission of genetic information from generation to generation

variation : the living organisms differ from each other, these differences are called variations

two types : 1. Continuous 2. Discontinuous

1. Continuous

→ unbroken range of the characteristics in the population

→ continuous variation from one extreme to the other

→ a full range of intermediate phenotypes b/w two extremes brought about by additive (combined) effect of genes

→ show that either many genes give the characteristic or the gene or genes are operating with environmental effects

→ e.g/ height, body, mass, intelligence

2. Discontinuous

→ distinct features

→ two or more separate forms of characteristic in the population

→ shows that a single gene gives the characteristic or the gene is operating with no environmental effect

→ discrete groups of phenotype with no or very few individuals in betwe

→ e.g/ blood group, tongue roll, ear lobe

heredity: tendency of an individual to resemble their parents

→ humans are called diploid organisms b/c they have two alleles at each genetic locus with one allele inherited from each parent

Laws of Inheritance:

1. Law of dominance and uniformity

→ some alleles are dominant while others are recessive; an organism with at least one dominant allele will display the effect of the dominant allele

for example:

Phenotype	Genotype
P ○ — ●	P YY — yy
(a). Cross Fertilization	(a). Cross Fertilization
F_1 ○ 100% yellow progeny (hybrids)	100% Yy (yellow) F_1
(b). Self Fertilization	(b). self Fertilization
F_2 ○ ○ ○ } 75% yellow progeny	F_2 25% YY, 50% Yy } yellow
● } 25% green progeny	25% yy } green

** the offspring in the F2 generation differ in genotype and phenotype so that the characteristics of grand parents (P-generation) will occur again

* in a dominant-recessive inheritance an average of 25% are homozygous with the dominant trait, 50% are heterozygous showing the dominant trait in phenotype and 25% are homozygous with the recessive trait genotypic ratio is 1:2:1

phenotypic ratio is 3:1

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Punett square : can be used to predict genotypes (allele combinations) and phenotypes (observable traits) of offsprings from genetic crosses

e.g)

	G1	G2
G1	AA	Aa
G2	Aa	aa

2. Laws of segregation

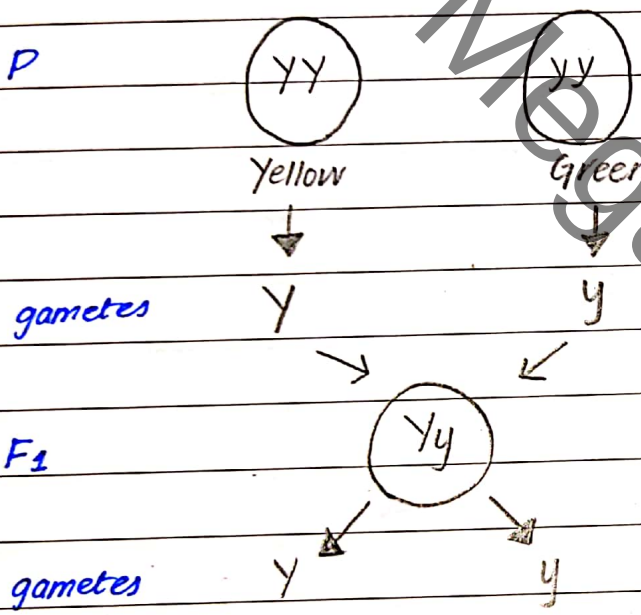
→ during gamete formation, the allele for each gene segragates from each other so that each gamete carries only one allele for each gene

→ genes come in different versions or alleles

→ a dominant allele hides a recessive allele and determines the organism's appearance.

→ when an organism makes gametes, each gamete just receives one gene copy which is selected randomly

Monohybrid Cross :



each homozygous parent in the P generation produces only one kind of gamete

The heterozygous F1 produces two kinds of gametes

F2

	Y	y
Y	YY	Yy
y	Yy	yy

self-pollination of the F1 offspring produces F2 offspring with a 3:1 ratio of Yellow to Green seeds

Phenotypes	Genotypes	Genotype ratio	Phenotype ratio
Yellow	YY	1	3
	Yy	2	
Green	yy	1	1